

**Course ID: ECE 440 Introduction to Computer Networks-Spring**  
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**235D/ Office Hours: Tuesdays and Thursdays 2:00pm-3:00pm**  
**Lectures: Tuesdays and Thursdays 3:30pm-4:45pm**  
**Department of Electrical and Computer Engineering / University of New Mexico**

**Homework #3 (100%)**

**1. Problem P5, Chapter 3 (30%)**

Suppose that the UDP receiver computes the Internet checksum for the received UDP segment and finds that it matches the value carried in the checksum field. Can the receiver be certain that no bit errors have occurred? Explain

**2. Problem P27, Chapter 3 (30%)**

Host A and B are communicating over a TCP connection, and Host B has already received from A all bytes up through byte 126. Suppose Host A then sends two segments to Host B back-to-back. The first and second segments contain 80 and 40 bytes of data, respectively. In the first segment, the sequence number is 127, the source port number is 302, and the destination port number is 80. Host B sends an acknowledgment whenever it receives a segment from Host A.

- a. In the second segment from Host A to B, what are the sequence number, source port number, and destination port number?
- b. If the first segment arrives before the second segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number, the source port number, and the destination port number?
- c. If the second segment arrives before the first segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number?
- d. Suppose the two segments sent by A arrive in order at B. The first acknowledgment is lost, and the second acknowledgment arrives after the first timeout interval. Draw a timing diagram, showing these segments and all other segments and acknowledgments sent. (Assume there is no additional packet loss.) For each segment in your figure, provide the sequence number and the number of bytes of data; for each acknowledgment that you add, provide the acknowledgment number?

**3. (40%) A TCP connection is established at time slot  $t=0$ , the MSS is equal to 1KB and  $RTT=100ms$ . Given that no packets are being lost, which time slot the congestion window will be equal to 16KB.**

When the congestion window becomes equal to 16KB, there is a timeout. The sender keeps sending packets. If there is no loss of packets, after how much time the congestion window will be equal to 14KB?

If the congestion window is equal to 14KB, the sender receives four acknowledgments with the same sequence number. How much time after receiving the fourth acknowledgment, the congestion window will be equal to 9KB?

To be delivered at instructor's email by **2 April 2019**

Good Luck!